

AMENDMENT TO  
APPLICATION FOR LICENSE  
RADIO STATION KCBC  
MANTECA, CALIFORNIA

BMML-20100322AES

Kiertron, Inc.

April 22, 2010

770 kHz 50 kW-D/4.1 kW-N DA-2



CRAWFORD  
BROADCASTING  
COMPANY

## EXECUTIVE SUMMARY

An application for license to cover a construction permit for a change in nighttime facilities for radio station KCBC, Manteca, California (FCC FID No. 34587, BP-20090820ABR) pursuant to the AM technical rules permitting moment-method modeling of eligible AM directional arrays [47 C.F.R. §73.151(c)] was filed on March 22, 2010 (BMML-20100322AES). The Media Bureau engineering staff identified several areas that needed correction along with some additional information.

For the sake of completeness, the corrected engineering exhibits of the application are included herewith in their entirety. The corrected/amended sections are identified as follows:

The calibration model for tower 1 incorrectly listed the electrical height of the radiator as 92.95747 meters. The correct tower 1 calibrated electrical height is 92.57893 meters. The corrected "Table 1 – Analysis of Tower Impedance Measurements to Verify Moment Method Model" is shown on page 3. The corrected tower 1 calibration model is shown on page 4 – 5.

As a result of the change in the tower 1 calibrated model electrical height, the assumed value of the series feed inductance changed from 3.63 uH to 4.03 uH. The corrected circuit model for the tower 1 base is shown on page 6.

The calibration model for tower 2 also incorrectly listed the electrical height of tower 1. This was corrected and the model re-run. This corrected model is shown on pages 7 – 8. The resulting modeled base impedance of tower 2 did not change as a result, so there is no change to the tower 2 base circuit model.

The tower 3 calibration model was correct in all aspects and was not changed.

The staff requested a showing comparing the daytime standard pattern with the inverted (mode 2) pattern. That showing is provided on page 14 herein.

There was no need to correct and re-run the day and night directional antenna models because the tower 1 calibrated electrical height was correct in these models. The tower 1 directional circuit models, however, were corrected to reflect the new assumed value of the tower 1 series feed reactance. These corrections are shown on pages 21 and 28 for the day and night patterns, respectively.

No changes resulted to the current or phase offsets from the small change in the tower 1 assumed series feed reactance. As a result, there were no changes in the base (antenna monitor) operating parameters for either pattern.

A surveyor's certification of the tower locations is attached hereto as Appendix B. The analysis of this certification is provided on page 29.

Reference field strength measurement point descriptions were added as requested to Appendix A.

### Analysis of Tower Impedance Measurements to Verify Method of Moments Model

Tower base impedance measurements were made at the final J-plugs within the Antenna Tuning Units (ATUs) using a General Radio 1606B impedance bridge. The other towers were all open-circuited at the same points where the impedance measurements were made for them. This arrangement left only the short feed tubing between the ATU outputs and the tower base in series in the impedance measurements. Static drain chokes are situated upstream of the output J-plug and sample transformer at each tower and as such were not a factor in the base impedance measurements nor the antenna circuit models.

ACSModel (MININEC 3.1 core) was used to model the KCBC daytime array.

A lumped load with a reactance of  $-j10,000$  was modeled at the base of the other towers to simulate an open circuit at each tower base.

The tower heights were adjusted in the model in order to achieve calibration of the model with the measured base impedances. All modeled tower heights were within 75 to 125 percent of the physical tower height as required by the FCC Rules.

The modeled radius for each tower was the physical radius of the tower as determined by the formula  $3T/2\pi$ , where T is the tower face width in meters. The KCBC radiators are uniform cross-section triangular towers and have face widths of 0.4827 meters. Each tower's radius was modeled at 0.23 meters.

Each tower is fed with a short length of large-diameter copper tubing that exhibits a small amount of series inductive reactance. This tubing connects to each tower immediately above the base insulator.

A circuit model was constructed for each tower using the assumed series feed tubing and shunt base region reactances. This model was used with the Westberg Circuit Analysis Program (WCAP) to determine the effects of these reactances on the ATU output impedance at each tower. In each of the WCAP tabulations, node 2 represents the ATU output reference point and node 3 represents the tower base. Node 0 represents ground potential. The ATU output impedances can be found in the "TO NODE IMPEDANCE" column of each WCAP tabulation, following the phantom 1.0 ohm resistor inserted in the model to provide a calculation point for the impedance. The complex base impedance of each tower from the moment method model is represented in each case by the complex load from node 3 to ground. A value of 80 pF was assumed for the base insulator, and this appears in the WCAP tabulation from node 3 to ground as 0.001 (microfarads) due to rounding. The WCAP circuit model tabulation immediately follows the model for each tower.

§73.151(c)(1)(vii) permits the use of a lumped series inductance of 10 uH or less between the output port of each antenna tuning unit and the associated tower. In each case, the value of lumped series inductance was below this 10 uH limit.

The modeled and measured impedances at the ATU output J-plugs with the other towers open-circuited at their ATU output J-plugs agree within  $\pm 2$  ohms and  $\pm 4$  percent as required by the FCC rules.

**Table 1 – Analysis of Tower Impedance Measurements to Verify Moment Method Model**

Twr.	$Z_{\text{BASE}}$ (Modeled)	$Z_{\text{ATU}}$ (Modeled)	$Z_{\text{ATU}}$ (Measured)	Series L (uH)	Shunt C pF	Phys. Height (deg.)	Model Height (deg.)	% Phys. Height
1	34.5 –j3.8	34.4 +j15.2	35.0 +j15.2	4.03	90	81.7	85.600	104.8
2	33.2 –j4.4	33.1 +j9.0	33.2 +j9.0	2.87	90	81.7	85.575	104.7
3	34.8 –j2.7	34.7 +j13.6	34.7 +j13.6	3.47	90	81.7	85.800	105.0

\*\*\*\*\*  
 ACSModel  
 (MININEC 3.1 Core)  
 04-01-2010 14:07:16  
 \*\*\*\*\*

KCBC  
 Tower 1 Driven  
 Towers 2 and 3 Floating

Frequency = 0.770 MHz Wavelength = 389.35066 Meters

No. of Wires: 3

Wire No. 1	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
0	0	0		-1		
0	0	92.57893	0.23	0		20
Wire No. 2	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
36.46333	90.24991	0		-2		
36.46333	90.24991	92.5519	0.23	0		20
Wire No. 3	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
72.92666	180.4998	0		-3		
72.92666	180.4998	92.79524	0.23	0		20

\*\*\*\* ANTENNA GEOMETRY \*\*\*\*

Wire No. 1	Coordinates			Radius	Connection		Pulse
X	Y	Z		End1	End2	No.	
0	0	0	0.23	-1	1	1	
0	0	4.628947	0.23	1	1	2	
0	0	9.257894	0.23	1	1	3	
0	0	13.88684	0.23	1	1	4	
0	0	18.51579	0.23	1	1	5	
0	0	23.14473	0.23	1	1	6	
0	0	27.77368	0.23	1	1	7	
0	0	32.40263	0.23	1	1	8	
0	0	37.03157	0.23	1	1	9	
0	0	41.66052	0.23	1	1	10	
0	0	46.28947	0.23	1	1	11	
0	0	50.91842	0.23	1	1	12	
0	0	55.54736	0.23	1	1	13	
0	0	60.17631	0.23	1	1	14	
0	0	64.80525	0.23	1	1	15	
0	0	69.4342	0.23	1	1	16	
0	0	74.06315	0.23	1	1	17	
0	0	78.69209	0.23	1	1	18	
0	0	83.32104	0.23	1	1	19	
0	0	87.94999	0.23	1	0	20	

Wire No.	2	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
36.46333	90.24991	0		0.23	-2	2	21	
36.46333	90.24991	4.627595		0.23	2	2	22	
36.46333	90.24991	9.25519		0.23	2	2	23	
36.46333	90.24991	13.88278		0.23	2	2	24	
36.46333	90.24991	18.51038		0.23	2	2	25	
36.46333	90.24991	23.13797		0.23	2	2	26	
36.46333	90.24991	27.76557		0.23	2	2	27	
36.46333	90.24991	32.39317		0.23	2	2	28	
36.46333	90.24991	37.02076		0.23	2	2	29	
36.46333	90.24991	41.64835		0.23	2	2	30	
36.46333	90.24991	46.27595		0.23	2	2	31	
36.46333	90.24991	50.90354		0.23	2	2	32	
36.46333	90.24991	55.53114		0.23	2	2	33	
36.46333	90.24991	60.15873		0.23	2	2	34	
36.46333	90.24991	64.78633		0.23	2	2	35	
36.46333	90.24991	69.41393		0.23	2	2	36	
36.46333	90.24991	74.04152		0.23	2	2	37	
36.46333	90.24991	78.66911		0.23	2	2	38	
36.46333	90.24991	83.29671		0.23	2	2	39	
36.46333	90.24991	87.9243		0.23	2	0	40	

Wire No.	3	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
72.92666	180.4998	0		0.23	-3	3	41	
72.92666	180.4998	4.639762		0.23	3	3	42	
72.92666	180.4998	9.279524		0.23	3	3	43	
72.92666	180.4998	13.91929		0.23	3	3	44	
72.92666	180.4998	18.55905		0.23	3	3	45	
72.92666	180.4998	23.19881		0.23	3	3	46	
72.92666	180.4998	27.83857		0.23	3	3	47	
72.92666	180.4998	32.47834		0.23	3	3	48	
72.92666	180.4998	37.1181		0.23	3	3	49	
72.92666	180.4998	41.75786		0.23	3	3	50	
72.92666	180.4998	46.39762		0.23	3	3	51	
72.92666	180.4998	51.03738		0.23	3	3	52	
72.92666	180.4998	55.67715		0.23	3	3	53	
72.92666	180.4998	60.31691		0.23	3	3	54	
72.92666	180.4998	64.95667		0.23	3	3	55	
72.92666	180.4998	69.59643		0.23	3	3	56	
72.92666	180.4998	74.23619		0.23	3	3	57	
72.92666	180.4998	78.87596		0.23	3	3	58	
72.92666	180.4998	83.51572		0.23	3	3	59	
72.92666	180.4998	88.15548		0.23	3	0	60	

Sources: 1  
Pulse No., Voltage Magnitude, Phase (Degrees): 1, 1.0, 0.0

Number of Loads: 2  
Pulse No., Resistance, Reactance: 21 , 0 , -10000  
Pulse No., Resistance, Reactance: 41 , 0 , -10000

```

***** SOURCE DATA *****
Pulse 1      Voltage = (1.0, 0.0j)
              Current = (0.0286, 0.0032j)
              Impedance = (34.537, -3.815j)
              Power = 0.014303 Watts

```

# WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = KCBC-1.CIR

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	4.0300	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	34.5000	3	0	-3.8000	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT FROM NODE IMPEDANCE TO NODE IMPEDANCE					
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		38.5007	23.2340							
2		37.5839	23.8354							
3		34.6474	-7.1447							
			BRANCH VOLTAGE							
			MAG	PHASE						
VSWR										
R	1- 2	1.000	1.00	.000	1.00	.000	35.38	15.19	34.38	15.19
L	2- 3	4.030	19.50	90.000	1.00	.000	34.38	15.19	34.38	-4.31
C	3- 0	.000	34.65	-7.145	.02	82.855	.00	-2296.61	.00	.00
R	3- 0	34.500	34.65	-7.145	1.00	-.859	34.50	-3.80	.00	.00

\*\*\*\*\*  
 ACSModel  
 (MININEC 3.1 Core)  
 04-01-2010 14:08:39  
 \*\*\*\*\*

KCBC  
 Tower 2 Driven  
 Towers 1 and 3 Floating

Frequency = 0.770 MHz Wavelength = 389.35066 Meters

No. of Wires: 3

Wire No. 1	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
0	0	0		-1		
0	0	92.57893	0.23	0		20
Wire No. 2	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
36.46333	90.24991	0		-2		
36.46333	90.24991	92.5519	0.23	0		20
Wire No. 3	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
72.92666	180.4998	0		-3		
72.92666	180.4998	92.79524	0.23	0		20

\*\*\*\* ANTENNA GEOMETRY \*\*\*\*

Wire No. 1	Coordinates			Radius	Connection		Pulse
X	Y	Z		End1	End2	No.	
0	0	0	0.23	-1	1	1	
0	0	4.628947	0.23	1	1	2	
0	0	9.257894	0.23	1	1	3	
0	0	13.88684	0.23	1	1	4	
0	0	18.51579	0.23	1	1	5	
0	0	23.14473	0.23	1	1	6	
0	0	27.77368	0.23	1	1	7	
0	0	32.40263	0.23	1	1	8	
0	0	37.03157	0.23	1	1	9	
0	0	41.66052	0.23	1	1	10	
0	0	46.28947	0.23	1	1	11	
0	0	50.91842	0.23	1	1	12	
0	0	55.54736	0.23	1	1	13	
0	0	60.17631	0.23	1	1	14	
0	0	64.80525	0.23	1	1	15	
0	0	69.4342	0.23	1	1	16	
0	0	74.06315	0.23	1	1	17	
0	0	78.69209	0.23	1	1	18	
0	0	83.32104	0.23	1	1	19	
0	0	87.94999	0.23	1	0	20	

Wire No.	2	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
36.46333	90.24991	0		0.23	-2	2	21	
36.46333	90.24991	4.627595		0.23	2	2	22	
36.46333	90.24991	9.25519		0.23	2	2	23	
36.46333	90.24991	13.88278		0.23	2	2	24	
36.46333	90.24991	18.51038		0.23	2	2	25	
36.46333	90.24991	23.13797		0.23	2	2	26	
36.46333	90.24991	27.76557		0.23	2	2	27	
36.46333	90.24991	32.39317		0.23	2	2	28	
36.46333	90.24991	37.02076		0.23	2	2	29	
36.46333	90.24991	41.64835		0.23	2	2	30	
36.46333	90.24991	46.27595		0.23	2	2	31	
36.46333	90.24991	50.90354		0.23	2	2	32	
36.46333	90.24991	55.53114		0.23	2	2	33	
36.46333	90.24991	60.15873		0.23	2	2	34	
36.46333	90.24991	64.78633		0.23	2	2	35	
36.46333	90.24991	69.41393		0.23	2	2	36	
36.46333	90.24991	74.04152		0.23	2	2	37	
36.46333	90.24991	78.66911		0.23	2	2	38	
36.46333	90.24991	83.29671		0.23	2	2	39	
36.46333	90.24991	87.9243		0.23	2	0	40	

Wire No.	3	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
72.92666	180.4998	0		0.23	-3	3	41	
72.92666	180.4998	4.639762		0.23	3	3	42	
72.92666	180.4998	9.279524		0.23	3	3	43	
72.92666	180.4998	13.91929		0.23	3	3	44	
72.92666	180.4998	18.55905		0.23	3	3	45	
72.92666	180.4998	23.19881		0.23	3	3	46	
72.92666	180.4998	27.83857		0.23	3	3	47	
72.92666	180.4998	32.47834		0.23	3	3	48	
72.92666	180.4998	37.1181		0.23	3	3	49	
72.92666	180.4998	41.75786		0.23	3	3	50	
72.92666	180.4998	46.39762		0.23	3	3	51	
72.92666	180.4998	51.03738		0.23	3	3	52	
72.92666	180.4998	55.67715		0.23	3	3	53	
72.92666	180.4998	60.31691		0.23	3	3	54	
72.92666	180.4998	64.95667		0.23	3	3	55	
72.92666	180.4998	69.59643		0.23	3	3	56	
72.92666	180.4998	74.23619		0.23	3	3	57	
72.92666	180.4998	78.87596		0.23	3	3	58	
72.92666	180.4998	83.51572		0.23	3	3	59	
72.92666	180.4998	88.15548		0.23	3	0	60	

Sources: 1  
Pulse No., Voltage Magnitude, Phase (Degrees): 21, 1.0, 0.0

Number of Loads: 2  
Pulse No., Resistance, Reactance: 1, 0, -10000  
Pulse No., Resistance, Reactance: 41, 0, -10000

\*\*\*\*\* SOURCE DATA \*\*\*\*\*  
Pulse 21 Voltage = (1.0, 0.0j)  
Current = (0.0296, 0.0039j)  
Impedance = (33.215, -4.416j)  
Power = 0.014792 Watts

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = KCBC-2.CIR

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	2.8700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	33.2000	3	0	-4.4160	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT FROM NODE IMPEDANCE TO NODE IMPEDANCE					
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		35.2339		14.7954						
2		34.2680		15.2224						
3		33.4250		-8.4083						
VSWR										
R	1- 2	1.000	1.00	.000	1.00	.000	34.07	9.00	33.07	9.00
L	2- 3	2.870	13.89	90.000	1.00	.000	33.07	9.00	33.07	-4.89
C	3- 0	.000	33.43	-8.408	.01	81.592	.00	-2296.61	.00	.00
R	3- 0	33.200	33.43	-8.408	1.00	-.827	33.20	-4.42	.00	.00

\*\*\*\*\*  
 ACSModel  
 (MININEC 3.1 Core)  
 01-08-2010 08:27:25  
 \*\*\*\*\*

KCBC  
 Tower 3 Driven  
 Towers 1 and 2 Floating

Frequency = 0.770 MHz Wavelength = 389.35066 Meters

No. of Wires: 3

Wire No. 1	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
0	0	0		-1		
0	0	92.57893	0.23	0		20
Wire No. 2	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
36.46333	90.24991	0		-2		
36.46333	90.24991	92.5519	0.23	0		20
Wire No. 3	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
72.92666	180.4998	0		-3		
72.92666	180.4998	92.79524	0.23	0		20

\*\*\*\* ANTENNA GEOMETRY \*\*\*\*

Wire No. 1	Coordinates			Radius	Connection		Pulse
X	Y	Z		End1	End2	No.	
0	0	0	0.23	-1	1	1	
0	0	4.628947	0.23	1	1	2	
0	0	9.257894	0.23	1	1	3	
0	0	13.88684	0.23	1	1	4	
0	0	18.51579	0.23	1	1	5	
0	0	23.14473	0.23	1	1	6	
0	0	27.77368	0.23	1	1	7	
0	0	32.40263	0.23	1	1	8	
0	0	37.03157	0.23	1	1	9	
0	0	41.66052	0.23	1	1	10	
0	0	46.28947	0.23	1	1	11	
0	0	50.91842	0.23	1	1	12	
0	0	55.54736	0.23	1	1	13	
0	0	60.17631	0.23	1	1	14	
0	0	64.80525	0.23	1	1	15	
0	0	69.4342	0.23	1	1	16	
0	0	74.06315	0.23	1	1	17	
0	0	78.69209	0.23	1	1	18	
0	0	83.32104	0.23	1	1	19	
0	0	87.94999	0.23	1	0	20	

Wire No.	2	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
36.46333	90.24991	0		0.23	-2	2	21	
36.46333	90.24991	4.627595		0.23	2	2	22	
36.46333	90.24991	9.25519		0.23	2	2	23	
36.46333	90.24991	13.88278		0.23	2	2	24	
36.46333	90.24991	18.51038		0.23	2	2	25	
36.46333	90.24991	23.13797		0.23	2	2	26	
36.46333	90.24991	27.76557		0.23	2	2	27	
36.46333	90.24991	32.39317		0.23	2	2	28	
36.46333	90.24991	37.02076		0.23	2	2	29	
36.46333	90.24991	41.64835		0.23	2	2	30	
36.46333	90.24991	46.27595		0.23	2	2	31	
36.46333	90.24991	50.90354		0.23	2	2	32	
36.46333	90.24991	55.53114		0.23	2	2	33	
36.46333	90.24991	60.15873		0.23	2	2	34	
36.46333	90.24991	64.78633		0.23	2	2	35	
36.46333	90.24991	69.41393		0.23	2	2	36	
36.46333	90.24991	74.04152		0.23	2	2	37	
36.46333	90.24991	78.66911		0.23	2	2	38	
36.46333	90.24991	83.29671		0.23	2	2	39	
36.46333	90.24991	87.9243		0.23	2	0	40	

Wire No.	3	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
72.92666	180.4998	0		0.23	-3	3	41	
72.92666	180.4998	4.639762		0.23	3	3	42	
72.92666	180.4998	9.279524		0.23	3	3	43	
72.92666	180.4998	13.91929		0.23	3	3	44	
72.92666	180.4998	18.55905		0.23	3	3	45	
72.92666	180.4998	23.19881		0.23	3	3	46	
72.92666	180.4998	27.83857		0.23	3	3	47	
72.92666	180.4998	32.47834		0.23	3	3	48	
72.92666	180.4998	37.1181		0.23	3	3	49	
72.92666	180.4998	41.75786		0.23	3	3	50	
72.92666	180.4998	46.39762		0.23	3	3	51	
72.92666	180.4998	51.03738		0.23	3	3	52	
72.92666	180.4998	55.67715		0.23	3	3	53	
72.92666	180.4998	60.31691		0.23	3	3	54	
72.92666	180.4998	64.95667		0.23	3	3	55	
72.92666	180.4998	69.59643		0.23	3	3	56	
72.92666	180.4998	74.23619		0.23	3	3	57	
72.92666	180.4998	78.87596		0.23	3	3	58	
72.92666	180.4998	83.51572		0.23	3	3	59	
72.92666	180.4998	88.15548		0.23	3	0	60	

Sources: 1  
Pulse No., Voltage Magnitude, Phase (Degrees): 41, 1.0, 0.0

Number of Loads: 2  
Pulse No., Resistance, Reactance: 1 , 0 , -10000  
Pulse No., Resistance, Reactance: 21 , 0 , -10000

\*\*\*\*\* SOURCE DATA \*\*\*\*\*  
Pulse 41 Voltage = (1.0, 0.0j)  
Current = (0.0286, 0.0022j)  
Impedance = (34.798, -2.676j)  
Power = 0.014284 Watts

# WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = KCBC-3.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	3.4700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	34.7980	3	0	-2.6760	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT FROM NODE IMPEDANCE TO NODE IMPEDANCE					
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		38.2076		20.8354						
2		37.2747		21.3821						
3		34.8561		-5.2645						
			BRANCH VOLTAGE							
			MAG	PHASE						
VSWR										
R	1- 2	1.000	1.00	.000	1.00	.000	35.71	13.59	34.71	13.59
L	2- 3	3.470	16.79	90.000	1.00	.000	34.71	13.59	34.71	-3.20
C	3- 0	.000	34.86	-5.265	.02	84.735	.00	-2296.61	.00	.00
R	3- 0	34.798	34.86	-5.265	1.00	-.867	34.80	-2.68	.00	.00

### Derivation of Operating Parameters for Daytime Directional Antenna

Once calibrated against the measured individual open-circuited base impedances, the moment method model was utilized for daytime directional antenna calculations. These calculations were made to determine the complex voltage source values to be applied at ground level for each tower of the array to produce the current moment sums for the towers which, when normalized to the reference tower, equate to the theoretical field parameters of the authorized directional pattern. These voltage sources were then applied in the model and the tower currents were calculated.

#### Alternate Mode

The KCBC licensed daytime operation is somewhat unique in that the array was originally configured and licensed using the “inverted” or alternate mode (mode 2) rather than the theoretical mode (mode 1). The theoretical (mode 1) parameters for the KCBC daytime array are as follows:

Twr.	Ratio	Phase
1	1.000	0.0
2	1.200	+104.0
3	0.360	+208.0

The alternate mode parameters are:

Twr.	Ratio	Phase
1	0.360	-208.0
2	1.200	-104.0
3	1.000	0.0

Normalized to a tower 2 reference, the theoretical parameters become:

Twr.	Ratio	Phase
1	0.300	-104.0
2	1.000	0.0
3	0.833	+104.0

Because the existing KCBC daytime phasing and coupling system was designed for operation in the alternate mode and because the alternate mode provides for much better power distribution and bandwidth, it is desired to continue operation in the “inverted” or alternate mode (mode 2). As such, the alternate mode tower-2-normalized parameters were used in the daytime directional antenna model.

A table comparing the mode 1 parameter standard pattern and alternate mode tower-2-normalized radiation values by azimuth is shown below. In no azimuth does the alternate mode pattern radiation exceed the standard pattern radiation by more than 0.6 mV/m at 1 km.

**Comparison of Mode 1 and Mode 2 Radiation Values**

Azimuth Deg.	Mode 1 mV/m	Mode 2 mV/m	Azimuth Deg.	Mode 1 mV/m	Mode 2 mV/m
0	718.7	718.7	180	2672.6	2672.7
5	578.1	578.0	185	2880.5	2880.5
10	465.4	465.2	190	3076.4	3067.4
15	379.9	379.6	195	3231.3	3231.3
20	319.4	319.0	200	3371.2	3371.2
25	280.8	280.3	205	3487.6	3487.6
30	260.2	259.6	210	3581.7	3581.7
35	253.4	252.9	215	3655.7	3655.7
40	256.5	256.0	220	3712.1	3712.1
45	265.7	265.2	225	3753.7	3753.7
50	277.7	277.3	230	3783.2	3783.2
55	289.6	289.1	235	3803.0	3803.0
60	299.0	298.6	240	3815.2	3815.2
65	304.4	304.0	245	3821.2	3821.2
70	304.9	304.5	250	3821.7	3821.7
75	300.5	300.0	255	3816.9	3816.9
80	291.7	291.3	260	3806.0	3806.0
85	280.2	279.7	265	3787.8	3787.9
90	268.0	267.5	270	3760.5	3760.5
95	258.0	257.5	275	3721.5	3721.5
100	253.4	252.8	280	3668.3	3668.3
105	257.8	257.3	285	3598.0	3598.1
110	275.4	274.9	290	3508.1	3508.2
115	310.1	309.6	295	3396.3	3396.4
120	365.9	365.6	300	3261.2	3261.2
125	446.2	446.0	305	3102.1	3102.1
130	553.3	553.2	310	2919.6	2919.7
135	688.4	688.3	315	2715.7	2715.7
140	851.0	850.6	320	2493.6	2493.6
145	1039.2	1039.2	325	2257.6	2257.7
150	1249.7	1249.7	330	2013.4	2013.5
155	1477.9	1478.0	335	1767.1	1767.1
160	1718.2	1718.2	340	1525.2	1525.2
165	1964.1	1964.2	345	1294.1	1294.1
170	2209.3	2209.3	350	1079.6	1079.6
175	2447.3	2447.4	355	886.6	886.6

### Daytime Antenna Model

Twenty segments were used for each tower. The KCBC towers are base sampled, which is permitted for towers of 120 electrical degrees or less. As such, the first (ground) segment of each tower was used to determine the model operating parameters of the array.

A circuit model was constructed to determine the effect of the series feed inductance and shunt base region capacitance on the ATU output current. Again, this model was used with the Westberg Circuit Analysis Program (WCAP).

This effect was, as expected, minimal, and the results are tabulated in the table below along with the base operating parameters for the daytime array.

Twr.	Node	Current Magnitude (amperes)	Current Phase (degrees)	WCAP Current Offset for Unity $I_{BASE}$	WCAP Phase Offset for Unity $\phi_{BASE}$ (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase (degrees)
1	1	10.4151	-97.2	1.060	-2.4	0.235	-99.4
2	21	41.9038	+3.6	1.004	-1.0	1.000	0.0
3	41	36.4259	105.7	0.993	-0.4	0.879	+101.5

```

*****
          ACSModel
        (MININEC 3.1 Core)
      01-08-2010      06:51:12
*****

```

KCBC  
Directional Antenna Day

Frequency = 0.770 MHz      Wavelength = 389.35066 Meters

No. of Wires: 3

Wire No. 1	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
0	0	0			-1	
0	0	92.57893		0.23	0	20
Wire No. 2	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
36.46333	90.24991	0			-2	
36.46333	90.24991	92.5519		0.23	0	20
Wire No. 3	Coordinates			Radius	End Connection	No. of
X	Y	Z				
Segments						
72.92666	180.4998	0			-3	
72.92666	180.4998	92.79524		0.23	0	20

\*\*\*\* ANTENNA GEOMETRY \*\*\*\*

Wire No. 1	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.
0	0	0		0.23	-1	1	1
0	0	4.628947		0.23	1	1	2
0	0	9.257894		0.23	1	1	3
0	0	13.88684		0.23	1	1	4
0	0	18.51579		0.23	1	1	5
0	0	23.14473		0.23	1	1	6
0	0	27.77368		0.23	1	1	7
0	0	32.40263		0.23	1	1	8
0	0	37.03157		0.23	1	1	9
0	0	41.66052		0.23	1	1	10
0	0	46.28947		0.23	1	1	11
0	0	50.91842		0.23	1	1	12
0	0	55.54736		0.23	1	1	13
0	0	60.17631		0.23	1	1	14
0	0	64.80525		0.23	1	1	15
0	0	69.4342		0.23	1	1	16
0	0	74.06315		0.23	1	1	17
0	0	78.69209		0.23	1	1	18
0	0	83.32104		0.23	1	1	19
0	0	87.94999		0.23	1	0	20

Wire No.	2	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
36.46333	90.24991	0		0.23	-2	2	21	
36.46333	90.24991	4.627595		0.23	2	2	22	
36.46333	90.24991	9.25519		0.23	2	2	23	
36.46333	90.24991	13.88278		0.23	2	2	24	
36.46333	90.24991	18.51038		0.23	2	2	25	
36.46333	90.24991	23.13797		0.23	2	2	26	
36.46333	90.24991	27.76557		0.23	2	2	27	
36.46333	90.24991	32.39317		0.23	2	2	28	
36.46333	90.24991	37.02076		0.23	2	2	29	
36.46333	90.24991	41.64835		0.23	2	2	30	
36.46333	90.24991	46.27595		0.23	2	2	31	
36.46333	90.24991	50.90354		0.23	2	2	32	
36.46333	90.24991	55.53114		0.23	2	2	33	
36.46333	90.24991	60.15873		0.23	2	2	34	
36.46333	90.24991	64.78633		0.23	2	2	35	
36.46333	90.24991	69.41393		0.23	2	2	36	
36.46333	90.24991	74.04152		0.23	2	2	37	
36.46333	90.24991	78.66911		0.23	2	2	38	
36.46333	90.24991	83.29671		0.23	2	2	39	
36.46333	90.24991	87.9243		0.23	2	0	40	

Wire No.	3	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.	
72.92666	180.4998	0		0.23	-3	3	41	
72.92666	180.4998	4.639762		0.23	3	3	42	
72.92666	180.4998	9.279524		0.23	3	3	43	
72.92666	180.4998	13.91929		0.23	3	3	44	
72.92666	180.4998	18.55905		0.23	3	3	45	
72.92666	180.4998	23.19881		0.23	3	3	46	
72.92666	180.4998	27.83857		0.23	3	3	47	
72.92666	180.4998	32.47834		0.23	3	3	48	
72.92666	180.4998	37.1181		0.23	3	3	49	
72.92666	180.4998	41.75786		0.23	3	3	50	
72.92666	180.4998	46.39762		0.23	3	3	51	
72.92666	180.4998	51.03738		0.23	3	3	52	
72.92666	180.4998	55.67715		0.23	3	3	53	
72.92666	180.4998	60.31691		0.23	3	3	54	
72.92666	180.4998	64.95667		0.23	3	3	55	
72.92666	180.4998	69.59643		0.23	3	3	56	
72.92666	180.4998	74.23619		0.23	3	3	57	
72.92666	180.4998	78.87596		0.23	3	3	58	
72.92666	180.4998	83.51572		0.23	3	3	59	
72.92666	180.4998	88.15548		0.23	3	0	60	

Sources: 3

Pulse No., Voltage Magnitude, Phase (Degrees): 1, 1678.7, -41.1  
Pulse No., Voltage Magnitude, Phase (Degrees): 21, 1666.5, 18.0  
Pulse No., Voltage Magnitude, Phase (Degrees): 41, 858.9, 62.1

Number of Loads: 0

```

***** SOURCE DATA *****
Pulse 1      Voltage = (1265.7015, -1102.6646j)
              Current = (-1.306, -10.3329j)
              Impedance = (89.796, 133.842j)
              Power = 4870.35 Watts

```

Pulse 21 Voltage = (1585.04, 514.6601j)  
 Current = (41.8233, 2.5971j)  
 Impedance = (38.514, 9.914j)  
 Power = 33814.1 Watts

Pulse 41 Voltage = (402.1496, 758.9046j)  
 Current = (-9.8851, 35.059j)  
 Impedance = (17.056, -16.28j)  
 Power = 11315.55 Watts

Total Power = 50000.002 Watts

\*\*\*\*\* CURRENT DATA \*\*\*\*\*

Wire No. 1 :

Pulse No.	Real (Amps)	Imaginary (Amps)	Magnitude (Amps)	Phase (Degrees)
1	-1.306	-10.3329	10.4151	-97.2038
2	-1.7826	-10.8556	11.001	-99.3251
3	-2.0796	-11.1238	11.3165	-100.5891
4	-2.3094	-11.2667	11.5009	-101.5837
5	-2.4867	-11.3017	11.572	-102.4092
6	-2.6179	-11.2366	11.5376	-103.1145
7	-2.7059	-11.0761	11.4019	-103.7286
8	-2.7529	-10.8234	11.168	-104.2705
9	-2.7602	-10.4814	10.8387	-104.7536
10	-2.729	-10.0527	10.4165	-105.1882
11	-2.6604	-9.5401	9.9041	-105.5819
12	-2.5554	-8.9464	9.3042	-105.9409
13	-2.4149	-8.2743	8.6195	-106.2703
14	-2.2401	-7.5267	7.853	-106.5743
15	-2.0318	-6.7059	7.007	-106.8563
16	-1.7908	-5.8142	6.0837	-107.1195
17	-1.5175	-4.8522	5.084	-107.3666
18	-1.2114	-3.8187	4.0063	-107.6001
19	-0.8702	-2.7067	2.8432	-107.8226
20	-0.4866	-1.4942	1.5714	-108.0382
E	0.0	0.0	0.0	0.0

Wire No. 2 :

Pulse No.	Real (Amps)	Imaginary (Amps)	Magnitude (Amps)	Phase (Degrees)
21	41.8233	2.5971	41.9038	3.5533
22	41.9306	1.8994	41.9736	2.5937
23	41.7247	1.4342	41.7494	1.9686
24	41.2595	1.0401	41.2727	1.4441
25	40.5447	0.6964	40.5507	0.984
26	39.5867	0.3946	39.5887	0.571
27	38.3917	0.1307	38.392	0.195
28	36.9664	-0.0974	36.9665	-0.1509
29	35.3176	-0.2907	35.3188	-0.4716
30	33.4534	-0.4501	33.4564	-0.7709
31	31.3819	-0.5761	31.3872	-1.0517
32	29.112	-0.669	29.1197	-1.3165
33	26.6526	-0.7293	26.6626	-1.5674
34	24.0128	-0.7571	24.0247	-1.806
35	21.2007	-0.7529	21.214	-2.0339
36	18.2229	-0.7167	18.237	-2.2524
37	15.0826	-0.6487	15.0966	-2.4629
38	11.7762	-0.5485	11.7889	-2.6665
39	8.2832	-0.4145	8.2935	-2.8648
40	4.5383	-0.2427	4.5448	-3.0607
E	0.0	0.0	0.0	0.0

Wire No. 3 :

Pulse No.	Real (Amps)	Imaginary (Amps)	Magnitude (Amps)	Phase (Degrees)
41	-9.8851	35.059	36.4259	105.7462
42	-9.5256	34.7855	36.0662	105.3143
43	-9.2276	34.3793	35.5961	105.0244
44	-8.9144	33.8007	34.9565	104.7744
45	-8.5767	33.0467	34.1416	104.5491
46	-8.2114	32.1183	33.1513	104.3411
47	-7.8179	31.0183	31.9884	104.1463
48	-7.3967	29.751	30.6567	103.9618
49	-6.9489	28.3215	29.1616	103.7857
50	-6.4761	26.7358	27.509	103.6163
51	-5.9801	25.0002	25.7055	103.4526
52	-5.463	23.1218	23.7584	103.2935
53	-4.9267	21.1076	21.675	103.1382
54	-4.3735	18.9647	19.4624	102.9862
55	-3.8053	16.6995	17.1276	102.8368
56	-3.2238	14.3174	14.6759	102.6896
57	-2.6302	11.821	12.11	102.544
58	-2.0243	9.2074	9.4273	102.3996
59	-1.4035	6.4611	6.6117	102.2557
60	-0.7578	3.5315	3.6119	102.1103
E	0.0	0.0	0.0	0.0

\*\*\*\*\*

# BASE OPERATING PARAMETERS

\*\*\*\*\*

Twr.	Ratio	Phase
1	0.249	-100.8
2	1.000	0.0
3	0.869	102.2

Current Moments (amp-meters) Peak

Frequency: 770 kHz

Input Power: 50,000 Watts

Wire	Real	Imag	Vert. Current Moment Magnitude	Phase
1	-188.1962	-754.8145	777.9221	-104.00
2	2593.0734	0.0001	2593.0734	0.00
3	-522.5586	2095.8683	2160.0304	104.00

Medium wave array vertical current moment (amps-meters) peak  
(Calculation assumes tower wires are grouped together.  
The first wire of each group must contain the source.)

Tower	Real	Imag	Magnitude	Phase
1	-188.1962	-754.8145	777.9221	-104.00
2	2593.0734	0.0001	2593.0734	0.00
3	-522.5586	2095.8683	2160.0304	104.00

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = KCBC-D1.CIR

I	9.8163	0	1	-94.8268	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	4.0300	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	89.7960	3	0	133.8420	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE	
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		1825.8700		-38.1118						
2		1820.5010		-37.8535						
3		1678.5940		-41.0624						
			BRANCH VOLTAGE							
			MAG	PHASE						
VSWR										
R	1- 2	1.000	9.82	-94.827	9.82	-94.827	102.08	157.43	101.08	157.43
L	2- 3	3.630	172.40	-4.827	9.82	-94.827	101.08	155.49	101.08	137.93
C	3- 0	.000	1678.59	-41.062	.73	48.938	.00	-2296.61	.00	.00
R	3- 0	89.796	1678.59	-41.062	10.41	-97.204	89.80	133.84	.00	.00

FILE NAME = KCBC-D2.CIR

I	41.7285	0	1	4.5183	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	2.8700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	38.5140	3	0	9.9140	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE	
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		1923.4650		34.7204						
2		1887.5170		35.3577						
3		1666.4810		17.9887						
			BRANCH VOLTAGE							
			MAG	PHASE						
VSWR										
R	1- 2	1.000	41.73	4.518	41.73	4.518	39.84	23.19	38.84	23.19
L	2- 3	2.870	579.41	94.518	41.73	4.518	38.84	23.19	38.84	9.30
C	3- 0	.000	1666.48	17.989	.73	107.989	.00	-2296.61	.00	.00
R	3- 0	38.514	1666.48	17.989	41.90	3.553	38.51	9.91	.00	.00

FILE NAME = KCBC-D3.CIR

I	36.6864	0	1	106.1692	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	3.4700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	17.0560	3	0	-16.2800	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT		FROM NODE IMPEDANCE		TO NODE IMPEDANCE	
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		653.8544		107.7724						
2		617.1832		107.8677						
3		858.8983		62.0802						
			BRANCH VOLTAGE							
			MAG	PHASE						
VSWR										
R	1- 2	1.000	36.69	106.169	36.69	106.169	17.82	.50	16.82	.50
L	2- 3	3.470	615.89	-163.831	36.69	106.169	16.82	.50	16.82	-16.29
C	3- 0	.000	858.90	62.080	.37	152.080	.00	-2296.61	.00	.00
R	3- 0	17.056	858.90	62.080	36.43	105.747	17.06	-16.28	.00	.00

### Derivation of Operating Parameters for Nighttime Directional Antenna

As with the daytime array, once calibrated against the measured individual open-circuited base impedances, the moment method model was utilized for nighttime directional antenna calculations. These calculations were made to determine the complex voltage source values to be applied at ground level for each tower of the array to produce the current moment sums for the towers which, when normalized to the reference tower, equate to the theoretical field parameters of the authorized directional pattern. These voltage sources were then applied in the model and the tower currents were calculated.

#### Nighttime Antenna Model

As with the daytime array, twenty segments were used for each tower. The KCBC towers are base sampled for the nighttime pattern as well as the day, so the first (ground) segment of each tower was used to determine the model operating parameters of the array.

A circuit model was constructed to determine the effect of the series feed inductance and shunt base region capacitance on the ATU output current. Again, this model was used with the Westberg Circuit Analysis Program (WCAP).

This effect was, as expected, minimal, and the results are tabulated in the table below along with the base operating parameters for the nighttime array.

Twr.	Node	Current Magnitude (amperes)	Current Phase (degrees)	WCAP Current Offset for Unity $I_{BASE}$	WCAP Phase Offset for Unity $\phi_{BASE}$ (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase (degrees)
1	1	12.1851	-134.6	1.015	-0.4	0.658	-135.7
2	21	18.2917	+1.2	1.004	-0.3	1.000	0.0
3	41	12.0258	151.1	0.997	-0.3	0.662	+149.9

```

*****
                        ACSModel
                      (MININEC 3.1 Core)
                    01-07-2010      13:33:52
*****

```

KCBC  
Directional Antenna Night

Frequency = 0.770 MHz      Wavelength = 389.35066 Meters

No. of Wires: 3

Wire No. 1	Coordinates			Radius	End	No. of
X	Y	Z			Connection	
	Segments					
0	0	0			-1	
0	0	92.57893		0.23	0	20
Wire No. 2	Coordinates			Radius	End	No. of
X	Y	Z			Connection	
	Segments					
36.46333	90.24991	0			-2	
36.46333	90.24991	92.5519		0.23	0	20
Wire No. 3	Coordinates			Radius	End	No. of
X	Y	Z			Connection	
	Segments					
72.92666	180.4998	0			-3	
72.92666	180.4998	92.79524		0.23	0	20

\*\*\*\* ANTENNA GEOMETRY \*\*\*\*

Wire No. 1	Coordinates			Radius	Connection		Pulse
X	Y	Z			End1	End2	No.
0	0	0		0.23	-1	1	1
0	0	4.628947		0.23	1	1	2
0	0	9.257894		0.23	1	1	3
0	0	13.88684		0.23	1	1	4
0	0	18.51579		0.23	1	1	5
0	0	23.14473		0.23	1	1	6
0	0	27.77368		0.23	1	1	7
0	0	32.40263		0.23	1	1	8
0	0	37.03157		0.23	1	1	9
0	0	41.66052		0.23	1	1	10
0	0	46.28947		0.23	1	1	11
0	0	50.91842		0.23	1	1	12
0	0	55.54736		0.23	1	1	13
0	0	60.17631		0.23	1	1	14
0	0	64.80525		0.23	1	1	15
0	0	69.4342		0.23	1	1	16
0	0	74.06315		0.23	1	1	17
0	0	78.69209		0.23	1	1	18
0	0	83.32104		0.23	1	1	19
0	0	87.94999		0.23	1	0	20

Wire No.	2	Coordinates			Connection		Pulse
X	Y	Z	Radius	End1	End2	No.	
36.46333	90.24991	0	0.23	-2	2	21	
36.46333	90.24991	4.627595	0.23	2	2	22	
36.46333	90.24991	9.25519	0.23	2	2	23	
36.46333	90.24991	13.88278	0.23	2	2	24	
36.46333	90.24991	18.51038	0.23	2	2	25	
36.46333	90.24991	23.13797	0.23	2	2	26	
36.46333	90.24991	27.76557	0.23	2	2	27	
36.46333	90.24991	32.39317	0.23	2	2	28	
36.46333	90.24991	37.02076	0.23	2	2	29	
36.46333	90.24991	41.64835	0.23	2	2	30	
36.46333	90.24991	46.27595	0.23	2	2	31	
36.46333	90.24991	50.90354	0.23	2	2	32	
36.46333	90.24991	55.53114	0.23	2	2	33	
36.46333	90.24991	60.15873	0.23	2	2	34	
36.46333	90.24991	64.78633	0.23	2	2	35	
36.46333	90.24991	69.41393	0.23	2	2	36	
36.46333	90.24991	74.04152	0.23	2	2	37	
36.46333	90.24991	78.66911	0.23	2	2	38	
36.46333	90.24991	83.29671	0.23	2	2	39	
36.46333	90.24991	87.9243	0.23	2	0	40	

Wire No.	3	Coordinates			Connection		Pulse
X	Y	Z	Radius	End1	End2	No.	
72.92666	180.4998	0	0.23	-3	3	41	
72.92666	180.4998	4.639762	0.23	3	3	42	
72.92666	180.4998	9.279524	0.23	3	3	43	
72.92666	180.4998	13.91929	0.23	3	3	44	
72.92666	180.4998	18.55905	0.23	3	3	45	
72.92666	180.4998	23.19881	0.23	3	3	46	
72.92666	180.4998	27.83857	0.23	3	3	47	
72.92666	180.4998	32.47834	0.23	3	3	48	
72.92666	180.4998	37.1181	0.23	3	3	49	
72.92666	180.4998	41.75786	0.23	3	3	50	
72.92666	180.4998	46.39762	0.23	3	3	51	
72.92666	180.4998	51.03738	0.23	3	3	52	
72.92666	180.4998	55.67715	0.23	3	3	53	
72.92666	180.4998	60.31691	0.23	3	3	54	
72.92666	180.4998	64.95667	0.23	3	3	55	
72.92666	180.4998	69.59643	0.23	3	3	56	
72.92666	180.4998	74.23619	0.23	3	3	57	
72.92666	180.4998	78.87596	0.23	3	3	58	
72.92666	180.4998	83.51572	0.23	3	3	59	
72.92666	180.4998	88.15548	0.23	3	0	60	

Sources: 3

Pulse No., Voltage Magnitude, Phase (Degrees): 1, 474.2, -68.9

Pulse No., Voltage Magnitude, Phase (Degrees): 21, 286.9, 37.2

Pulse No., Voltage Magnitude, Phase (Degrees): 41, 163.7, 114.3

Number of Loads: 0

```

***** SOURCE DATA *****
Pulse 1      Voltage = (170.691, -442.4496j)
              Current = (-8.5578, -8.6741j)
              Impedance = (16.01, 35.474j)
              Power = 1188.56 Watts

```

Pulse 21 Voltage = (228.5323, 173.5086j)  
 Current = (18.2876, 0.3841j)  
 Impedance = (12.69, 9.221j)  
 Power = 2122.98 Watts

Pulse 41 Voltage = (-67.4043, 149.2105j)  
 Current = (-10.5277, 5.8125j)  
 Impedance = (10.904, -8.153j)  
 Power = 788.45 Watts

Total Power = 4100.000 Watts

\*\*\*\*\* CURRENT DATA \*\*\*\*\*

Wire No. 1 :

Pulse No.	Real (Amps)	Imaginary (Amps)	Magnitude (Amps)	Phase (Degrees)
1	-8.5578	-8.6741	12.1851	-134.6132
2	-8.7265	-8.7243	12.3396	-135.0073
3	-8.7784	-8.6996	12.359	-135.2585
4	-8.7589	-8.6177	12.2875	-135.4654
5	-8.6743	-8.4815	12.1318	-135.6439
6	-8.528	-8.2927	11.8952	-135.8014
7	-8.3221	-8.0527	11.5803	-135.9425
8	-8.0584	-7.7629	11.1893	-136.0701
9	-7.7389	-7.4249	10.7248	-136.1864
10	-7.3655	-7.0403	10.189	-136.2931
11	-6.9401	-6.6109	9.5848	-136.3914
12	-6.4647	-6.1385	8.9148	-136.4825
13	-5.9415	-5.625	8.1818	-136.5673
14	-5.3725	-5.0723	7.3886	-136.6465
15	-4.7597	-4.482	6.5378	-136.7209
16	-4.1045	-3.8556	5.6314	-136.7911
17	-3.4078	-3.1937	4.6704	-136.8576
18	-2.6687	-2.4955	3.6537	-136.921
19	-1.8825	-1.7566	2.5748	-136.9819
20	-1.0343	-0.9631	1.4133	-137.0415
E	0.0	0.0	0.0	0.0

Wire No. 2 :				
Pulse	Real	Imaginary	Magnitude	Phase
No.	(Amps)	(Amps)	(Amps)	(Degrees)
21	18.2876	0.3841	18.2917	1.2034
22	18.3119	0.2834	18.3141	0.8866
23	18.2069	0.2159	18.2081	0.6793
24	17.9909	0.1583	17.9916	0.5042
25	17.6675	0.1077	17.6678	0.3494
26	17.2393	0.063	17.2394	0.2094
27	16.7089	0.0235	16.7089	0.0806
28	16.0793	-0.0109	16.0793	-0.039
29	15.3534	-0.0405	15.3535	-0.1511
30	14.5349	-0.0652	14.5351	-0.257
31	13.6274	-0.085	13.6276	-0.3575
32	12.6347	-0.1	12.6351	-0.4535
33	11.5611	-0.1101	11.5616	-0.5457
34	10.4103	-0.1153	10.4109	-0.6345
35	9.1861	-0.1155	9.1869	-0.7205
36	7.8916	-0.1108	7.8923	-0.8041
37	6.5281	-0.1009	6.5289	-0.8857
38	5.0942	-0.0859	5.0949	-0.9657
39	3.5812	-0.0653	3.5818	-1.0446
40	1.961	-0.0385	1.9614	-1.1236
E	0.0	0.0	0.0	0.0

Wire No. 3 :				
Pulse	Real	Imaginary	Magnitude	Phase
No.	(Amps)	(Amps)	(Amps)	(Degrees)
41	-10.5277	5.8125	12.0258	151.0962
42	-10.4329	5.8257	11.9493	150.8211
43	-10.302	5.796	11.8205	150.6378
44	-10.1204	5.7304	11.6301	150.4805
45	-9.8867	5.6303	11.3775	150.3393
46	-9.6012	5.4965	11.0632	150.2096
47	-9.2648	5.3299	10.6885	150.0886
48	-8.8787	5.1314	10.2549	149.9744
49	-8.4448	4.902	9.7644	149.8657
50	-7.9647	4.6427	9.2191	149.7616
51	-7.4407	4.3548	8.6214	149.6613
52	-6.875	4.0393	7.9738	149.5641
53	-6.2698	3.6977	7.279	149.4695
54	-5.6274	3.3311	6.5394	149.3772
55	-4.9499	2.9406	5.7575	149.2867
56	-4.2391	2.5273	4.9353	149.1977
57	-3.496	2.0915	4.0738	149.11
58	-2.7198	1.6327	3.1723	149.0233
59	-1.9063	1.1482	2.2254	148.937
60	-1.0406	0.629	1.2159	148.8502
E	0.0	0.0	0.0	0.0

\*\*\*\*\* BASE OPERATING PARAMETERS \*\*\*\*\*

Twr.	Ratio	Phase
1	0.666	-135.8
2	1.000	0.0
3	0.657	149.9

Current Moments (amp-meters) Peak

Frequency: 770 kHz  
Input Power: 4,100 Watts

Wire			Vert. Current Moment	
	Real	Imag	Magnitude	Phase
1	-563.8345	-544.4886	783.8222	-136.00
2	1127.8018	0.0000	1127.8018	0.00
3	-625.0912	360.8965	721.7932	150.00

Medium wave array vertical current moment (amps-meters) peak  
(Calculation assumes tower wires are grouped together.  
The first wire of each group must contain the source.)

Tower			Magnitude	
	Real	Imag	Magnitude	Phase
1	-563.8345	-544.4886	783.8222	-136.00
2	1127.8018	0.0000	1127.8018	0.00
3	-625.0912	360.8965	721.7932	150.00

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = KCBC-N1.CIR

I	11.9968	0	1	-134.2072	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	4.0300	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	16.0100	3	0	35.4740	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT FROM NODE IMPEDANCE TO NODE IMPEDANCE					
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		675.0740		-62.3429						
2		671.4366		-61.3700						
3		474.2224		-68.9033						
VSWR										
R	1- 2	1.000	12.00	-134.207	12.00	-134.207	17.52	55.41	16.52	55.41
L	2- 3	3.630	210.69	-44.207	12.00	-134.207	16.52	55.41	16.52	35.91
C	3- 0	.000	474.22	-68.903	.21	21.097	.00	-2296.61	.00	.00
R	3- 0	16.010	474.22	-68.903	12.18	-134.613	16.01	35.47	.00	.00

FILE NAME = KCBC-N2.CIR

I	18.2188	0	1	1.5214	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	2.8700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	12.6900	3	0	9.2210	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT FROM NODE IMPEDANCE TO NODE IMPEDANCE					
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		489.7297		60.6515						
2		480.6362		62.5159						
3		286.9349		37.2070						
VSWR										
R	1- 2	1.000	18.22	1.521	18.22	1.521	13.79	23.07	12.79	23.07
L	2- 3	2.870	252.97	91.521	18.22	1.521	12.79	23.07	12.79	9.19
C	3- 0	.000	286.93	37.207	.12	127.207	.00	-2296.61	.00	.00
R	3- 0	12.690	286.93	37.207	18.29	1.204	12.69	9.22	.00	.00

FILE NAME = KCBC-N3.CIR

I	12.0680	0	1	151.3672	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	3.4700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	10.9070	3	0	-8.1530	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = .770

NODE		VOLT MAG	VOLT PHASE		BRANCH CURRENT FROM NODE IMPEDANCE TO NODE IMPEDANCE					
			MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
1		176.5891		-172.5763						
2		166.9840		-170.1384						
3		163.7518		114.3179						
VSWR										
R	1- 2	1.000	12.07	151.367	12.07	151.367	11.83	8.61	10.83	8.61
L	2- 3	3.470	202.60	-118.633	12.07	151.367	10.83	8.61	10.83	-8.18
C	3- 0	.000	163.75	114.318	.07	-155.682	.00	-2296.61	.00	.00
R	3- 0	10.907	163.75	114.318	12.03	151.096	10.91	-8.15	.00	.00

Summary of Post Construction Certified Array Geometry

With respect to Question 9, Section III, Page 2 of the attached Form 302-AM, the tower information is as follows:

Tower No.	ASRN	Height above base insulator (meters)	Height above ground w/o obst. lighting (meters)	Overall height above ground (meters)
1	1012846	88.4	89.8	90.8
2	1012847	88.4	89.8	90.8
3	1012848	88.4	89.8	90.8

All towers are uniform cross-section, steel, guyed vertical radiators.

Because KCBC is an existing licensed facility, in accordance with the Public Notice, Media Bureau Clarifies Procedures for AM Directional Antenna Performance Verification Using Moment Method Modeling (FCC DA 09-2340) dated October 29, 2009 ("Notice"), the daytime pattern is exempt from the requirement to submit a surveyor's certification. The nighttime pattern is new, however, and is thus subject to the requirement. A Certified Survey drawing is shown in Appendix B attached hereto.

The tower relative distances provided in feet on the Certified Survey drawing were converted to electrical degrees at 770 kHz and used along with the survey tower azimuths relative to True North to calculate the distance in electrical degrees from the location specified in the theoretical directional antenna pattern array geometry. For the sake of simplicity and because the array is symmetrical about the center tower (#2), the geometry was analyzed from the center tower location. Below is a tabulation showing those distances and other data that is relevant to their determination.

Twr.	Specified Array Geometry			As-Built Certification		Distance From Specified Base Location	
	Spacing (degrees)	Spacing (feet)	Azimuth (deg. T.)	Spacing (feet)	Azimuth (deg. T.)	(feet)	(deg.)
1	90	319.5	248.0	319.64	248.0	0.14	0.04
2	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
3	90	319.5	68.0	319.37	68.0	0.13	0.04

The as-built tower displacements from their specified locations expressed in electrical degrees at 770 kHz are all well below the 1.5 electrical degree tolerance specified by the FCC in the Notice.

### Sampling System

The sampling system consists of Delta Electronics TCT-1 current transformers installed at the output of each antenna tuning unit, immediately adjacent to the final J-plug. Samples from the current transformers are fed to the antenna monitor via equal lengths of 1/4-inch foam-dielectric coaxial transmission lines. The antenna monitor is a Potomac Instruments Type 1901.

Impedance measurements were made of the antenna sampling system using an Array Solutions AIM417B network analyzer. The measurements were made looking into the antenna monitor ends of the sample lines with the tower ends of the sample lines open-circuited.

The table below shows the frequencies above and below the carrier frequency where resonance, defined as zero reactance corresponding with low resistance, was found. As the length of distortionless transmission line is 180 electrical degrees at the difference frequency between adjacent frequencies of resonance, and frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sample line length at the resonant frequency above carrier frequency, which is the closest one to the carrier frequency, was found to be 270 electrical degrees. The electrical length at carrier frequency appearing in the table below was calculated by ratioing the frequencies.

Twr.	Sample Line Open-Circuited Resonance Below 770 kHz (kHz)	Sample Line Open-Circuited Resonance Above 770 kHz (kHz)	Sample Line Calculated Electrical Length At 770 kHz (deg.)
1	345.08	1043.9	199.2
2	345.08	1043.9	199.2
3	345.08	1043.6	199.2

Because the electrical lengths were determined to be identical to within the nearest 0.1 degree, the sample lines meet the requirement in the Rules that they be equal in length within one electrical degree.

To determine the characteristic impedance values of the sample lines, open-circuited measurements were made with frequencies offset to produce  $\pm 45$  degrees of electrical length from resonance.

The characteristic impedance was calculated using the following formula, where  $R_1 + jX_1$  and  $R_2 + jX_2$  are the measured impedances at the +45 and -45 degree offset frequencies, respectively:

$$Z_0 = ((R_1^2 + X_1^2)^{1/2} \times (R_2^2 + X_2^2)^{1/2})^{1/2}$$

Twr.	+ 45 Deg. Offset Frequency (kHz)	+45 Deg. Measured Impedance (ohms)	- 45 Deg. Offset Frequency (kHz)	-45 Deg. Measured Impedance (ohms)	Calculated Characteristic Impedance (ohms)
1	1217.883	9.7 +j48.9	869.917	6.6 -j49.3	49.8
2	1217.883	9.7 +j48.9	869.917	6.5 -j49.2	49.3
3	1217.533	9.7 +j48.9	869.667	6.5 -j49.1	49.7

The sample line measured characteristic impedances meet the requirement that they be equal within 2 ohms.

The calibration of the Delta TCT-1 current transformers was verified by removing them all from the ATUs and installing them on a test jig so that each was located very close to the adjacent transformer (spacing of less than two inches). Short transmission lines of equal length were connected between the outputs of all four current transformers and the inputs of the antenna monitor. The Potomac 1901 antenna monitor was calibrated using the internal calibration function. A single source of RF current on the carrier frequency was fed through a conductor passing through all of the current transformers, and the differential phases and ratios were noted on the antenna monitor as follows:

Twr.	Serial No.	Ratio	Phase (deg.)
1	2256	1.001	+0.3
2	2247	Ref.	Ref.
3	2123	0.998	-0.1

The requirement that the sample current transformers are accurate to within the manufacturer's specification ( $\pm 2\%$  ratio and  $\pm 2$  degrees phase) has thus been demonstrated.

The impedance of each of the sample lines was measured with the sample current transformers attached. These impedances are tabulated below:

Twr.	R (ohms)	X (ohms)
1	51.4	+j0.7
2	51.1	+j0.2
3	51.0	+j0.6

### Direct Measurement of Power

Common point impedance measurements were made using a Delta CPB-1A common point bridge installed in the common point bus of the phasing and coupling system. The resistance value was adjusted to 50 ohms and the reactance value was adjusted to zero.

## Appendix A

### Reference Field Strength Measurements

Reference field strength measurements were made on March 13-15, 2010 using a Potomac Instruments FIM-41 S/N 2142 and a Potomac Instruments FIM-21 S/N 688. Measurements were made at three locations along radials at the azimuths with radiation values specified on the construction permit and, additionally, on the major lobe radial. The measured field strengths and descriptions and NAD-27 GPS coordinates for the reference measurement points are shown in the following tables.

Daytime

Radial 35.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	5.15	37-50-07	120-51-00	03/14/2010	1423	46.0	Center of Dorsey Road, 740 meters west of 28 Mile Rd
2	8.37	37-51-34	120-49-41	03/14/2010	1431	16.6	Center of 28 Mile Road, 590 meters south of sharp turn to the west
3	11.10	37-52-45	120-48-37	03/15/2010	1648	15.2	Center of Sonora Road, next to drainage ditch

Radial 68.0°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	4.18	37-48-42	120-50-24	03/14/2010	1416	65.5	West side of 28 Mile Road, 45 meters south of large gate on east side
2	8.05	37-49-28	120-47-58	03/15/2010	1706	39.8	Center of Frankenheimer Road, 315 meters east of cross road to the north
3	15.61	37-50-57	120-43-13	03/14/2010	1512	16.4	South side of Sonmora Road, 530 meters east of driveway to the mansion

Radial 100.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	3.93	37-47-31	120-50-44	03/14/2010	1255	62.0	Center of Rodden 450 meters south of Rodden/28 Mile Road intersection
2	6.95	37-47-09	120-48-20	03/14/2010	1241	21.5	Center of road on Dillwood at intersection of Mallard Road
3	10.27	37-46-57	120-46-49	03/14/2010	1233	13.8	Center of road at end of Benja off of Orange Blossom Road

Radial 248°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	3.67	37-47-07	120-55-19	03/14/2010	1308	900.0	East side of Victory Ave. 1 km south of Hwy 120
2	8.00	37-46-14	120-58-03	03/14/2010	1317	400.0	Center of S. Harrold Rd .9 km north of River Road
3	20.79	37-43-38	121-06-11	03/14/2010	1339	108.0	On Hwy 99-Hammett Rd entrance north 150 meters (last tree)

### Nighttime

#### Radial 1.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	3.38	37-49-40	120-52-58	03/15/2010	1802	73.5	South side of Hinds Road, across from pole and intersection of 2 fences
2	6.60	37-51-25	120-52-54	03/13/2010	1336	32.5	South side of Dodds Road, 155 meters east of 26 mile road
3	9.81	37-53-11	120-52-51	03/15/2010	1820	24.0	10 meters south of Carter Road, 30 meters west of 26 Mile Road

#### Radial 39.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	2.25	37-48-47	120-52-04	03/15/2010	1756	50.5	East side of 26 Mile Road, 95 meters south of driveway going north/east
2	5.47	37-50-07	120-50-40	03/15/2010	1809	15.8	10 meters west of pole by corral on north side of Dorsey Road.
3	11.26	37-52-33	120-48-10	03/13/2010	1258	6.3	South side of Sonora Road, 180 meters south/east of driveway going s/w

#### Radial 68°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	4.18	37-48-42	120-50-24	03/13/2010	1221	38.0	West side of 28 Mile Road, 45 meters south of large gate on east side
2	7.88	37-49-28	120-48-07	03/13/2010	1232	21.2	Center of Frankenheimer Road, 85 meters east of cross road to the north
3	15.61	37-50-57	120-43-13	03/13/2010	1248	10.5	South side of Sonmora Road, 530 meters east of driveway to the mansion

#### Radial 96.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	3.90	37-47-37	120-50-21	03/15/2010	1753	21.1	East side of Rodden Rd 20 meters south of intersection Rodden/28 Mile Rd
2	5.40	37-47-32	120-49-21	03/15/2010	1747	16.0	South side of N. Hills Ct 80 meters east of Oak View Dr.
3	10.57	37-47-12	120-45-50	03/15/2010	1734	5.4	West side on curve of Orange Blossom Road 160 meters north of Gary Road

#### Radial 134.5°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	5.44	37-46-47	120-50-22	03/13/2010	1154	47.0	At Philip and Sylvia Orlando grave marker in cemetery at 6th and J streets
2	10.80	37-43-44	120-47-48	03/13/2010	1135	17.0	Center of Stoddard Rd 30 meters south of Bond Rd
3	13.60	37-42-40	120-46-27	03/13/2010	1121	15.4	On dirt road north side of Claribel Rd at Kearny Lateral

### Radial 161°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	4.10	37-45-45	120-52-03	10/15/2010	1812	31.0	Center of Maiden Lane 30 meters west of Willow Glen
2	7.63	37-43-58	120-51-18	10/15/2010	1822	13	South edge of Patterson Road 1.2 km east of Bentley Rd
3	10.14	37-42-40	120-50-44	10/15/2010	1831	9.1	North side of Cleribel Rd. 200 meters east of Albers Road

### Radial 248°

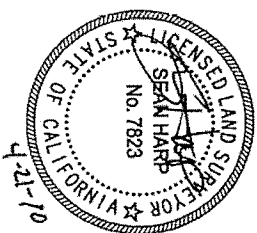
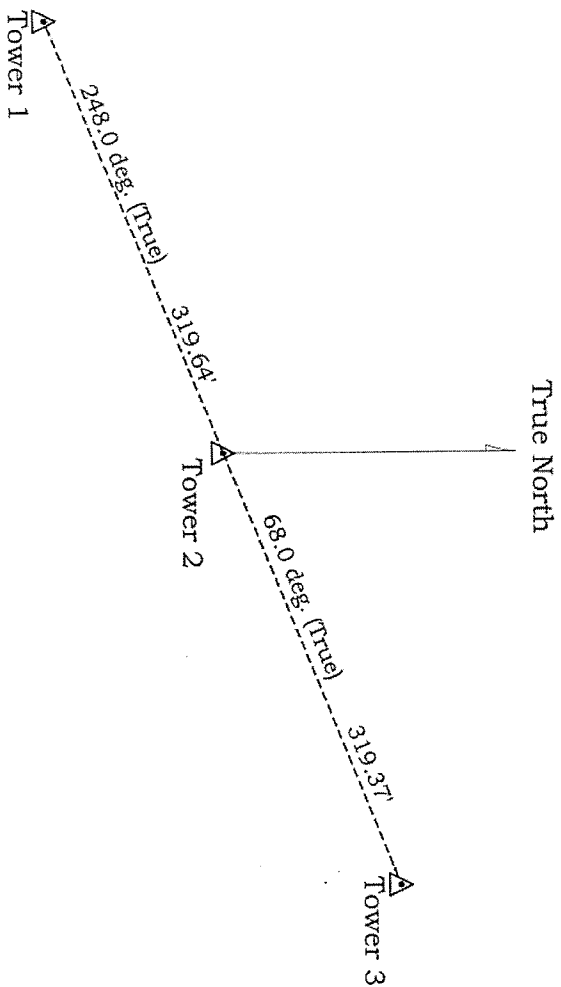
Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	3.67	37-47-07	120-55-19	03/13/2010	1319	300.0	East side of Victory Ave. 1 km south of Hwy 120
2	8.00	37-46-14	120-58-03	03/13/2010	1333	132.0	Center of S. Harrold Rd .9 km north of River Road
3	20.79	37-43-38	121-06-09	03/13/2010	1405	35.0	On Hwy 99-Hammett Rd entrance north 150 meters (last tree)


### Radial 335°

Point No.	Dist. km	Latitude	Longitude	Date	Time	Field mV/m	Point Description
1	3.70	37-49-41	120-54-06	03/15/2010	1746	24.6	North/east side of Lambuth Road, across from driveway
2	7.24	37-51-25	120-55-05	03/13/2010	1341	12.2	North side of Dodds Road, 95 meters east of driveway
3	16.25	37-55-50	120-57-44	03/13/2010	1406	5.3	North side of Route 4, 80 meters east of driveway

Appendix B

Certified Survey



 <b>GDR ENGINEERING, INC.</b> ENGINEERING/SURVEYING/PLANNING 3525 MITCHELL ROAD, SUITE G GERRIS, CA 95307 TELEPHONE: (209) 538-3380 FAX: (209) 538-7370 E-MAIL: GDRENGINEERING.COM	
<b>KCBC TOWER LAYOUT</b> <b>STANISLAUS COUNTY, CA</b>	
SCALE: 1" = 100'	DATE: APRIL 2010
DRAWN: SH	SHEET 1 of 1
DWG NO. 10009 TOWER.DWG	FILE NO. 10009